

SIEMENS



Smarter decisions, better products.

NX

Transforming the entire product development process with high-performance, integrated solutions for design, simulation and manufacturing

[www.siemens.com/nx](http://www.siemens.com/nx)

# Introducing NX

Globalization and increasing complexity – of products, markets, and development processes – are key opportunities for manufacturing companies. To succeed, manufacturers must improve their ability to perform more complicated engineering, design, analysis, and production tasks, and be capable of managing increasingly complex product information. Fortunately, advances in information technology make it possible not only to manage complexity, but also to improve your product development processes.

NX™, the product development solution from Siemens PLM Software, delivers the advanced performance and leading-edge technologies you need to master complexity and compete globally. Supporting every aspect of product development, NX delivers tightly integrated, unified solutions for design, simulation and manufacturing that are unmatched in power and flexibility. NX solutions redefine productivity and efficiency, helping you to deliver more innovative products faster and at lower cost.

More than integrated CAD/CAM/CAE, NX also provides collaboration, data management, process automation, and decision support tools that help you upgrade your development processes to gain and keep a competitive advantage.

Companies worldwide are realizing the distinct benefits of NX product development solutions. You can see immediate and long-term business results:

**Transform your product development process** to work smarter, not harder, finding new efficiencies to drive innovation and capitalize on market opportunities.

**Make accurate decisions faster** by providing up-to-date product information and analytics to better address engineering, design and manufacturing problems.

**Deliver products “right to market, first time”** by using virtual models and simulation to effectively evaluate product performance and manufacturability, and by continuously validating designs for compliance with industry, company, and customer requirements.

**Collaborate effectively with partners and suppliers** with technologies for sharing, communicating, and protecting product and manufacturing process information throughout the value chain.

**Support design from concept through manufacturing** with a comprehensive, integrated toolset that coordinates disciplines, preserves data integrity and design intent, and streamlines the entire development process.

# Where NX excels

## NX



### **Robust and powerful problem solving.**

NX addresses extremely complex product development problems. NX design tools have the performance and capacity to easily tackle complex geometry and massive assemblies. Advanced simulation capabilities in NX handle the most demanding CAE challenges, significantly reducing physical prototyping. NX also enables you to improve your manufacturing by taking advantage of today's most advanced tooling and machining technologies.

**Flexibility.** In addition to the best-in-class solution suite, NX provides unprecedented flexibility to employ technology of your own choosing. Your team can use a

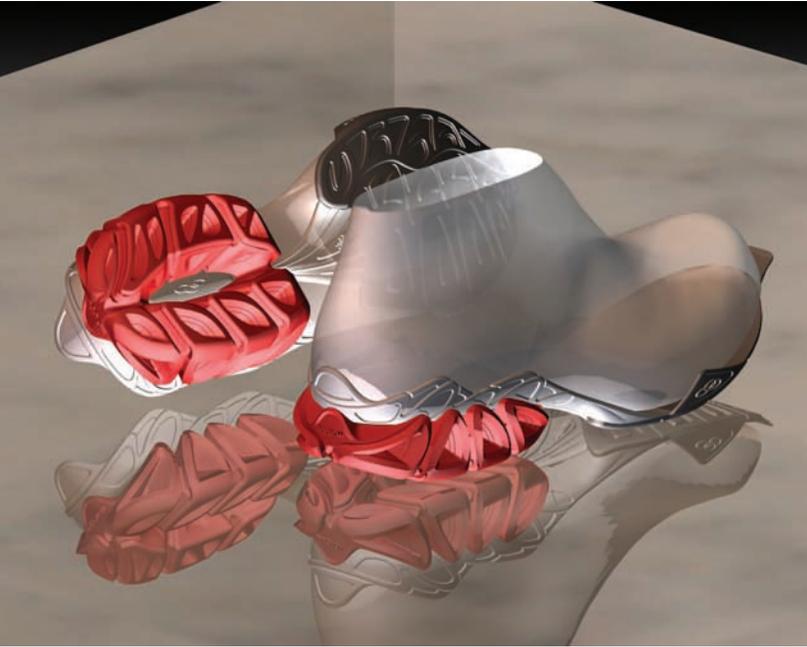
versatile selection of approaches, tools and techniques to accomplish development tasks – even if you are working with product data created in other systems.

**Coordination.** NX delivers a unified environment and consistent processes that can accelerate your cycle times. The seamless integration of NX applications enables you to rapidly propagate information and process changes across all development disciplines, from concept design to manufacturing. NX leverages Siemens' Teamcenter® PLM software to establish a single source of product and process knowledge that coordinates all phases of development, standardizes your processes and accelerates decision making.

**Productivity.** NX improves productivity in product design, engineering, simulation, tooling design and manufacturing through re-use. Your development teams can directly re-use CAD data from other systems – minimizing the need to re-master data and improving cycle times.

**Open environment.** NX open architecture enables you to protect your existing IT investments by readily incorporating solutions from other vendors in the digital product development process.

# Industrial design and styling



## **Advantages**

*Create distinctive designs in which style, aesthetic appearance, or quality of form is a key market differentiator*

*Consider styling, functionality, manufacturability and affordability throughout an iterative design process*

*Rapidly evaluate design concepts through photorealistic images and virtual prototypes*

*Eliminate disconnect between your design/styling teams and the rest of your product development organization*

*Design what you want and how you want it without the constraints of standalone design tools*

NX delivers an industrial design and styling toolset that helps develop distinctive designs with form, fit, and function for a positive customer experience. Concept designs then seamlessly transition through a complete concept-to-market process.

**Concept design and styling.** NX gives designers the freedom to develop their concepts using the most appropriate modeling approach, including standard parametric and freeform techniques, with surface analysis and advanced visualization for concept evaluation. With NX high-end surfacing tools, designers can create different surface types and combine curve-based surfacing, pole editing and sweeping into a single workflow that lets them choose the best modeling tool for the task at hand.

Sophisticated NX modeling and visualization tools let designers quickly refine the design concept by applying color, materials, textures and lighting. NX real-time rendering enables designers to generate advanced photo-realistic images for rapid

design review, while virtual prototyping can be used for rapid concept evaluation and iterative design validation.

**Reverse engineering.** NX can generate CAD models from scanned physical objects by mapping surfaces and curves to the polygon mesh. Designers can use NX analysis and rendering tools to rapidly evaluate the imported scan data.

**Full design completion.** NX has all of the tools and integration required to facilitate full design completion. NX enables you to take the concept model directly into product engineering, including detailed design, simulation, tooling and machining.

# Package design



## Advantages

*Create innovative package designs to attract customers in crowded, competitive marketplaces*

*Minimize cycle time from product/package design to manufacturing*

*Meet look and styling requirements while delivering functional, manufacturable and affordable package designs*

*Automate the design validation process to rapidly address today's environmental/green concerns*

*Maximize package design re-use by developing concept models with high quality surfaces that can be leveraged throughout a complete product lifecycle*

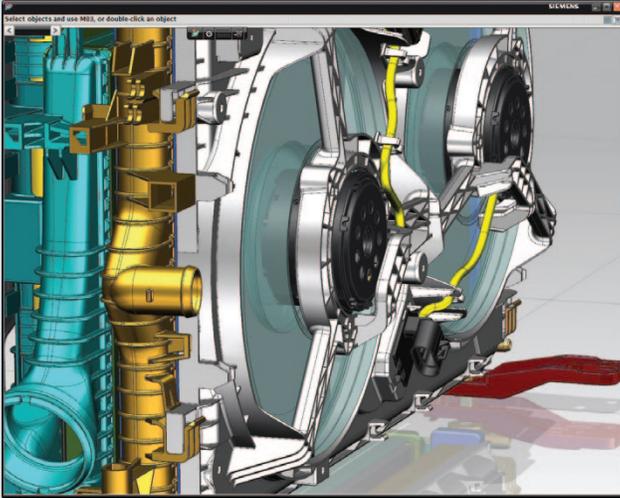
NX package design solutions enable you to deliver distinctive package designs that are visually compelling, as well as functionally superior in terms of their manufacturability, affordability and maintainability.

The complete NX toolset includes powerful design creation, shape editing and production surfacing capabilities – all the tools required to fully explore shape and style. Designers can create and modify package shapes using a combination of curve-, surface- and solid-based design techniques, with high-performance visualization tools to quickly refine the design concept by applying color, materials, textures and lighting. NX provides the freedom and control that designers require to evaluate and manipulate shapes in real time. Advanced real-time rendering produces photorealistic images that accelerate the packaging review cycle.

**Reverse engineering.** Reverse engineering capabilities greatly reduce the time required to initially develop the package design concept by scanning physical objects such as clay or foam models, then generating CAD models by mapping surfaces and curves to the polygon mesh. NX also provides tools to analyze scanned models for stress/crush, mold-fill, manufacturability and virtual consumer testing.

**“Green” compliance.** NX validation checking enables you to initiate an automatic process to ensure that your product and package designs comply with environmental, industry and customer-specified standards. You can use these capabilities to continuously monitor your designs as they evolve across the entire product lifecycle.

# Mechanical design



## **Advantages**

*Accelerate the design process and improve design throughput*

*Improve design team productivity and performance, especially when handling large complex models*

*Fully integrate all of your design teams across the entire development cycle by retaining design intent even when different disciplines use multiple CAD systems*

*Raise quality and minimize design errors with automated validation*

*Maximize design re-use by establishing common product platforms and building established best practices in your development processes*

Increasingly complex products require the participation of multiple teams, disciplines and suppliers using independent CAD systems and different modeling techniques. Leading edge CAD modeling tools in NX represent a breakthrough in terms of power, versatility, flexibility and productivity.

NX enables you to freely use any modeling technique that fits your design challenge with wireframe, surface, solid and direct modeling solutions. Powered by Siemens' groundbreaking synchronous technology, NX unites feature-based parametric and history-free modeling in the same environment. Designers can use NX to modify design geometry initially created on other CAD systems or by other modeling techniques.

NX includes process-specific modeling tools and workflows that deliver built-in expertise for routing, sheet metal, automotive design and other design tasks. You can leverage your product and process knowledge and industry best practices with knowledge-

enabled design. NX helps you capture and re-use knowledge in the form of high-level product structures, templates, frequently used design elements, engineering rules and validation checks to reduce design costs and improve design quality.

NX enables designers to easily navigate large assemblies and establish a context for detailed subassembly and component work. Design teams collaboratively view, modify and evaluate complete digital mockups with clearance and interference checking to eliminate fit problems. Path planning and motion envelopes optimize products for assembly, disassembly, maintenance and service.

# Electromechanical design



## **Advantages**

*Streamline development by uniting all domains, disciplines and processes into a single design environment*

*Reduce error and rework by integrating ECAD and MCAD domains and using PCB designs in your product assemblies*

*Incorporate a full set of electromechanical simulation capabilities to evaluate all major design failure modes and fix them early*

*Improve ease of use and productivity with process-specific sheet metal design, industrial design, routing and wire harness design tools*

*Boost engineering productivity by working with large assembly models and virtual prototypes*

NX coordinates disciplines and integrates mechanical, electrical, electronic and control system components, with analysis and manufacturing to support every stage of the electromechanical development cycle.

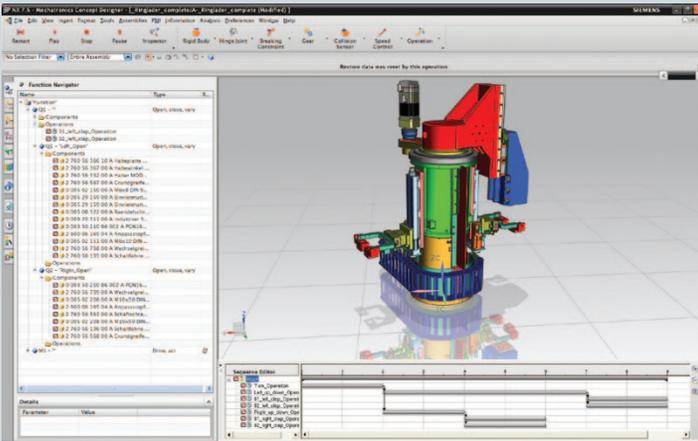
With two-way data exchange between your MCAD and ECAD domains, NX also provides specialized tools to coordinate and accelerate sheet metal, industrial design, and flexible printed circuit board design. Automation and validation tools capture product and process knowledge that you can re-use to reduce development time. Teamcenter-driven process management capabilities accelerate your product lifecycle and manage product variants.

**Systems-level engineering.** NX supports a systems-oriented approach with intelligent control structures that retain key design characteristics. NX automatically propagates design change to subassemblies and components to streamline the design of complex variants.

**Printed circuit board modeling and ECAD integration.** NX links your MCAD and ECAD systems for complete physical design, facilitating clearance checking, packaging and simulation with associative data transfer and management for PCBs.

**Routed systems and wire harness design integration.** With NX you can design and validate routed systems for mechanical and electrical designs. Designers can quickly apply logical design changes by using associative links between the P&ID layout and the 3D model. Process-specific tools for wire harness design reduce errors and rework by integrating control system design into a unified development process.

# Mechatronics concept design



## Advantages

*Reduce development time by 25 percent or more*

*Lower engineering costs with systems engineering approach*

*Evaluate concepts quickly in a virtual environment to minimize physical prototyping*

*Improve collaboration among mechanical, electrical, and automation disciplines*

*Easily re-use proven design elements with built-in mechatronics intelligence*

*Improve design quality and confidence with full visibility and traceability of product requirements*

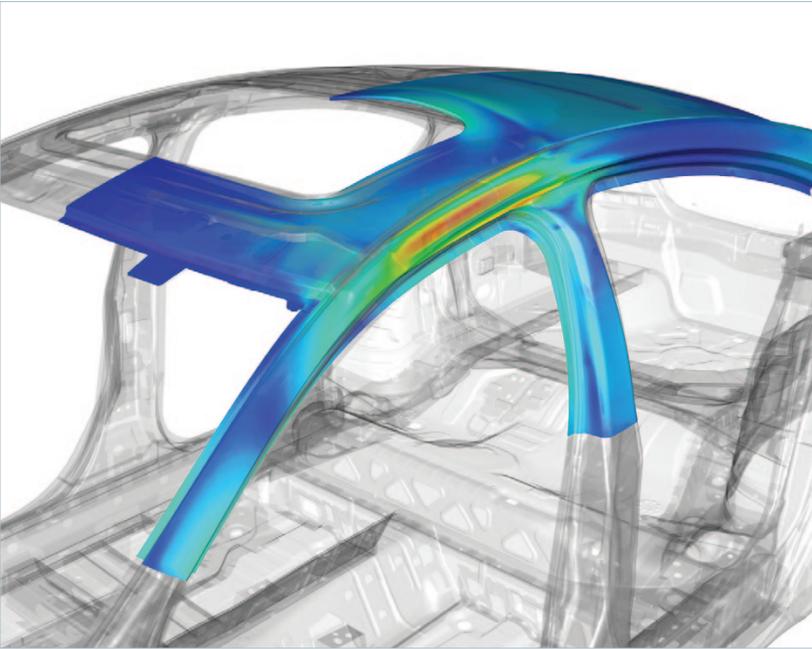
NX delivers a revolutionary solution for machine design. Mechatronics Concept Designer accelerates development of products that involve mechanical, electrical, and software design disciplines, allowing them to work in parallel, focused on a concept design that includes mechanical components, sensors, actuators, and motion.

Supporting a functional design approach, Mechatronics Concept Designer integrates upstream and downstream engineering domains, including requirements management, mechanical design, electrical design, and software/automation engineering. Using systems engineering principles, you can capture and support the behavioral and logical characteristics of mechatronic requirements from the beginning of the product development process. This approach enables you to trace requirements from the voice of the customer to the detailed design.

Mechatronics Concept Designer includes a physics-based simulation capability you can use to quickly create and validate alternative concepts early in the development cycle. Streamlined modeling tools help you create component models and specify kinematic and dynamic behavior. You can add sensors and actuators, and specify timing, positioning, and sequencing. The interactive simulation is available to verify proper machine operation at any time.

Concepts developed with Mechatronics Concept Designer include all of the design data needed for mechanical, electrical, and software engineering, enabling better interdisciplinary collaboration and accelerated detail design, all with direct reference and traceability to product requirements for better quality and confidence.

# Mechanical simulation



## Advantages

*Speed product development through more efficient simulation processes that produce results faster and impact critical design decisions earlier*

*Reduce development costs by replacing physical prototypes with virtual prototypes that can be simulated and iterated more quickly*

*Produce better products through simulation to evaluate more design alternatives and understand design/performance tradeoffs*

*Reduce warranty exposure by finding and resolving product issues earlier*

*Deliver products faster by automating simulation processes that leverage best practices*

Today's companies want to accelerate innovation by using simulation to evaluate different design alternatives, conduct experiments and gain new insights into product performance. However, some companies are unable to realize the full potential of their simulation investments because simulation continues to be disconnected from mainstream product development. NX comprehensive set of simulation tools enables you to integrate performance simulation earlier into your development process so you can investigate more design options and make better product decisions.

**Advanced engineering.** NX enables CAE teams to perform high-end analyses for structural, thermal, flow, motion or coupled physics. In addition to its broad and deep analysis solutions, finite element modeling in NX is one of the fastest, most productive preprocessors available. Prior to meshing, intuitive direct geometry editing tools let you

defeature and idealize geometry faster than traditional FEA preprocessors. NX also delivers extensive automatic and manual mesh tools for 1D, 2D and 3D elements, loads, and boundary conditions, along with unique technology for modeling large finite element assemblies.

**Design and design engineering.** NX offers easy to use geometry-based simulation solutions that facilitate rapid design feedback at the earliest stages of design. NX design-level solutions are powered by NX Nastran®, the same solver used by high-level analysts, but include built-in wizards and the ability to create custom wizards for guided simulation and process automation for less-experienced CAE users. NX synchronous technology also enables designers to quickly make geometry modifications and re-simulate to perform early "what-if" analyses. In addition to CAD-based finite element solutions for strength, vibration and

thermal analyses, NX also offers design-embedded motion simulation tools.

**NX-native CAE environments.** NX provides a unifying platform for incorporating in-house CAE software and popular CAE solutions into an NX-native environment, including Ansys, Abaqus, NX Nastran, MSC Nastran and LS-Dyna.

**Simulation process management.** NX offers out-of-the-box integration with Teamcenter for increased collaboration and greater visibility of simulation results throughout the organization.

# Electromechanical simulation



## **Advantages**

*Accelerate development by enabling cross-discipline MCAD, ECAD and CAE teams to work together and share models/data*

*Reduce development cost by leveraging a common data model that drives simulation across multiple disciplines and maximizes existing MCAD, ECAD and CAE investment*

*Improve product quality with broader virtual testing and optimization of design variables*

*Meet tight delivery schedules using a common requirements driven, managed simulation process*

Manufacturers increasingly need to blend mechanical, electrical, electronics and controls systems and components into their products. This requirement adds a new level of complexity to product development because multiple disciplines with unique skill sets and distinctive work processes have to collaborate.

NX electromechanical simulation solutions address all major causes of electromechanical product failure, including heat, vibration and impact, dust and moisture. In addition, NX supports a concurrent process in which designers and analysts can seamlessly work together while developing and testing a product's design. NX provides your simulation user community with best-in-class modeling tools and market-leading solvers for each step in the simulation process.

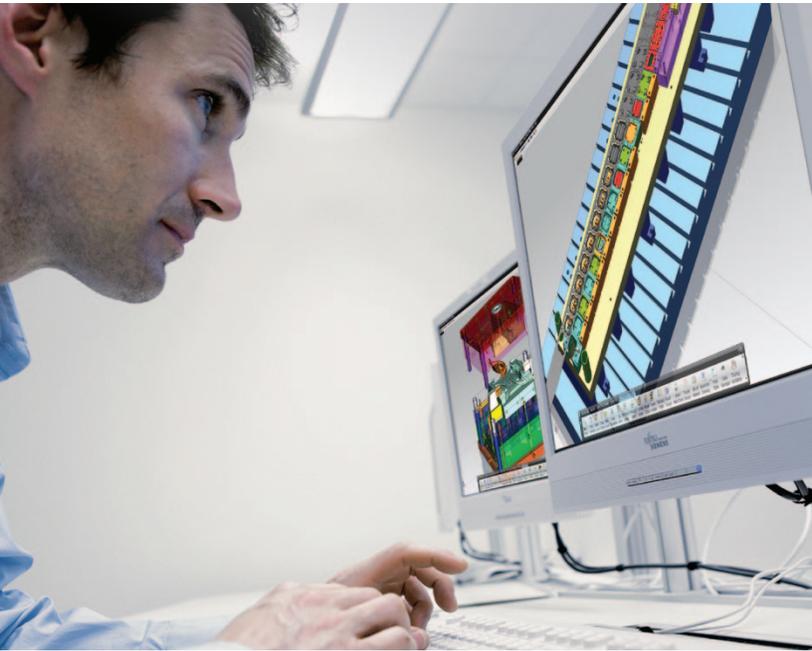
**Faster modeling.** NX users benefit from bi-directional data exchange with EDA design systems that prevents manual errors and miscommunication. Another time-consuming task for analysts is fluid domain creation. With NX direct geometry editing tools using synchronous technology, fluid domain creation is much faster. Equally important, since the NX fluid domain is fully associative with NX CAD data, the fluid domain is automatically updated after every design change.

**Systems engineering.** The ability to understand and predict how different systems will interact when brought together is crucial for electromechanical product development. NX Motion users can use co-simulation to understand and tune how an electronic controller will interact with their mechanical system prior to building the actual hardware. NX Electronics Systems Cooling offers a multi-physics environment to simulate thermo-fluid behavior in densely

packed electronic systems. NX Space Systems Thermal is specifically designed to handle orbital thermal analysis problems.

**Collaboration and data management.** Tight integration between NX and Teamcenter ensures that simulation engineers always have access to product requirements and the latest design data. These users are notified of any change that may require analyses to be re-computed. Additionally, by storing the results in Teamcenter, the entire development team can leverage simulation results to make better informed decisions.

# Tooling and fixture design



## **Advantages**

*Accelerate design-to-manufacture turnaround by reducing design lead time and minimizing manufacturing planning and machining time*

*Reduce tool design costs*

*Achieve first-time quality on complex parts*

*Improve teamwork across the entire part manufacturing process by early engineering and manufacturing validation and tightly integrating your supply chain*

*Reduce machining time by implementing high-speed machining processes that decrease electrode manufacturing and total mode manufacturing time*

NX tool and fixture design solutions dramatically outperform conventional tooling design systems. Their automated capabilities enable you to seamlessly move from part design to finished tool design in far less time and with fewer errors than traditional CAD applications.

NX addresses your entire tooling and fixture design process. The following advanced NX design, simulation and manufacturing capabilities drive these solutions.

**Mold design**, including NX molded part validation, core/cavity optimization and mold base design capabilities

**Engineering die design**, including best practices and automated processes for the design and validation of transfer and tandem dies

**Progressive die design**, including NX part preparation, process design and die structure design capabilities

**Automotive stamping die design**, including NX formability analysis, die planning, die face design, detailed die structure design and die validation capabilities

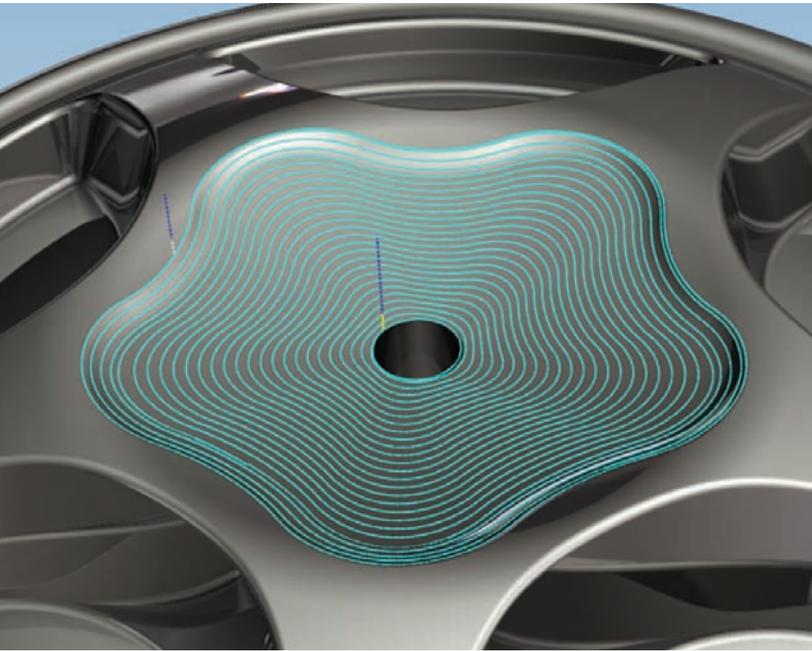
**Fixture design**, including NX fully associative component design, assembly positioning and mating, kinematic simulation, performance validation and component knowledge library capabilities

**CAM integration**, including capabilities for integrating NX CAM into your tool design solution to automate your downstream manufacturing definition

**Electrode design**, including best practices and automated processes you can use to model and design electrodes for any tool project that requires electrode discharge machining (EDM)

**Engineering process management**, including Teamcenter capabilities you can use to bring all of your product, part, tool, design, manufacturing and CAD data into a single source of knowledge, as well as to establish concurrent design processes for a comprehensive part manufacturing environment

# Machining



## **Advantages**

*Improve the productivity of your machine tools by taking advantage of the latest machine tool technologies and manufacturing processes*

*Save up to 90 percent on programming time by automating routine tasks*

*Achieve faster and repeatable NC programming by capturing and re-using proven machining processes*

*Get it right the first time on the shop floor by simulating and validating NC programs in the context of the machine tool process*

NX CAM provides a wide range of machine tool programming capabilities in a single integrated solution that enables you to take advantage of the latest machine tool technologies and manufacturing processes.

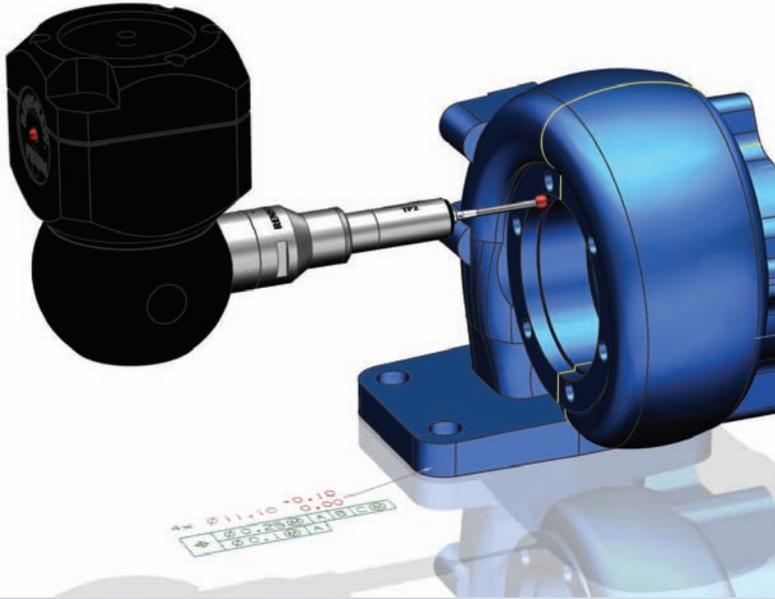
**Advanced capability.** NX high-speed machining strategies facilitate efficient hard milling while maintaining smooth motion and consistent chip loads. NX supports the latest generation of multi-function machine tools, including multi-channel milling, drilling and turning capabilities for simultaneous 5-axis support. NX facilitates a wide range of flexible 5-axis machining with many tool axis control options.

**Programming automation.** NX automated feature-based machining strategies enable you to apply machining processes to hole and surface features in the part model. Wizards and templates streamline typical programming processes. Embedded product manufacturing information (PMI) in an NX 3D model can drive your machining process decisions.

**Production-ready output.** G-code-driven machine tool simulation validates NX programs in the context of the machine tool. You can use NX Postbuilder's graphical user interface to create post processors with simple drag and drop techniques. Hundreds of posts are available in the NX online post processor library.

**Integrated part manufacturing.** NX CAM is totally integrated with other NX solutions accessing comprehensive design, assembly and drafting tools associatively in a single part manufacturing environment. Changes are handled easily. Programmers and manufacturing engineers can work with part models, create and assemble fixtures, develop tool paths and even model entire machines for 3D machining simulation in this environment.

# Quality inspection



## **Advantages**

*Dramatically reduce programming time (up to an 80 percent reduction)*

*Ensure all part requirements are inspected according to company standards*

*Capture and share best practices*

*Create programs off-line without using a physical part or machine*

*Facilitate fast and efficient design change propagation across entire process*

*Simplify software deployment footprint (single system for CAD, CAM and CMM)*

*Minimize training requirements*

NX provides a state-of-the-art solution for off-line programming of Coordinate Measuring Machines (CMM) that reduces programming time, frees up expensive machine resources and ensures fast responses to design changes. By combining industry knowledge and best practices with process automation, NX CMM Inspection Programming streamlines the entire CMM inspection program development process from feature definition and path creation to program generation and validation.

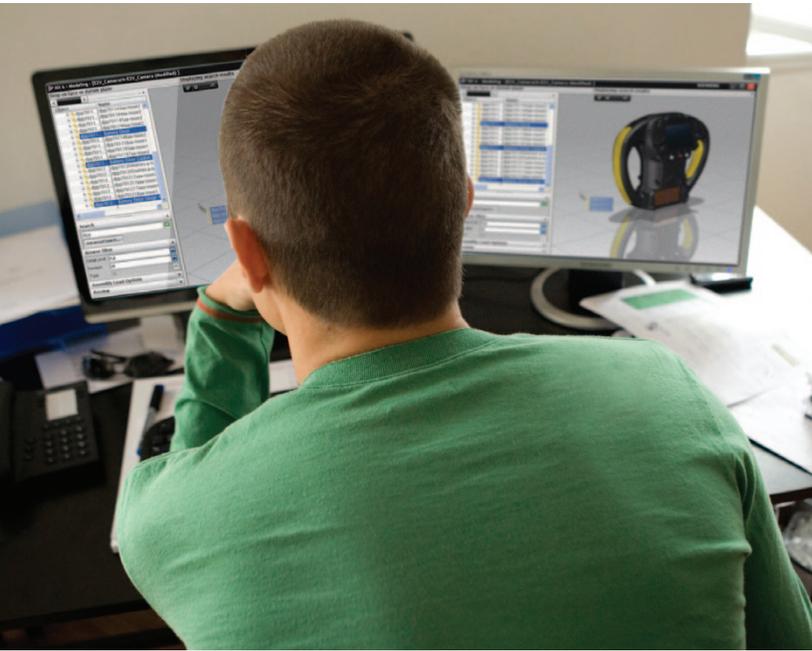
**Program definition.** NX CMM Inspection Programming enables you to use streamlined workflows to minimize ramp-up time and quickly generate collision-free programs. By using product and manufacturing information (PMI) on the model (including GD&T and 3D annotations) to automatically generate programs, you are well positioned to guarantee completeness.

You can further automate the programming process by applying your own standard inspection path methods, tools and project templates.

**Program validation.** Tolerance application automatically checks all tolerances to ensure that they are correctly applied to their associated feature. Collision prevention identifies and eliminates collisions before sending them to the machine. CMM Machine Simulation uses kinematic model-based simulations of the machine to verify that all features are reachable and machine limits are not exceeded.

**Program output.** Certified DMIS output is the industry standard for coordinate measuring machines. NX also provides options for customized output to generate programs for other CMM languages.

# Engineering process management



## **Advantages**

*Enabling dispersed development teams to work together as a single entity regardless of location*

*Implement design-anywhere, build-anywhere initiatives with a single source of product and process knowledge*

*Reduce cost and accelerate processes by consistently managing change across your entire product lifecycle*

*Eliminate ambiguity and streamline development with clear and concise visual information*

*Maximize enterprise performance by bringing industry-leading, best-in-class development applications together in a unified environment*

NX provides a single source of product engineering and process knowledge. Powered by Teamcenter, engineering process management allows globally dispersed groups that use different technologies to work as one team and maximize the quality, value and timeliness of the products they deliver.

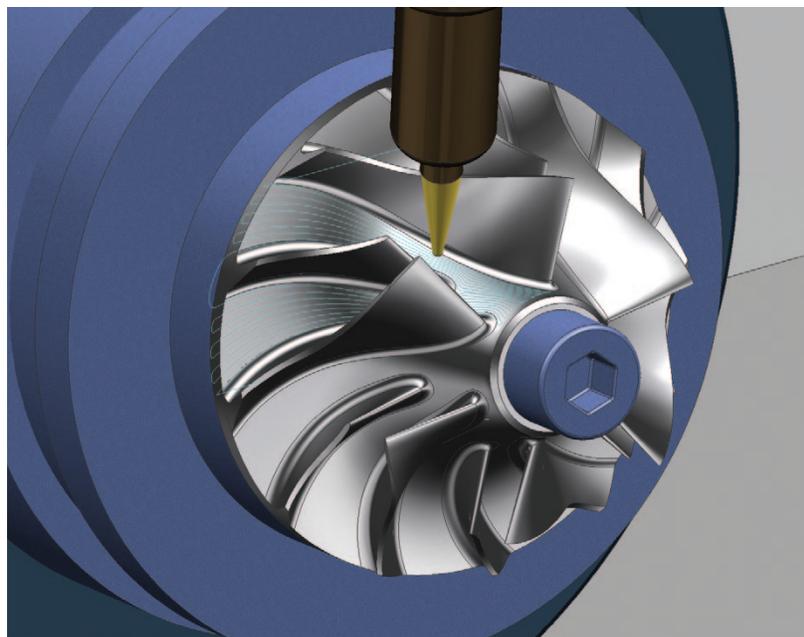
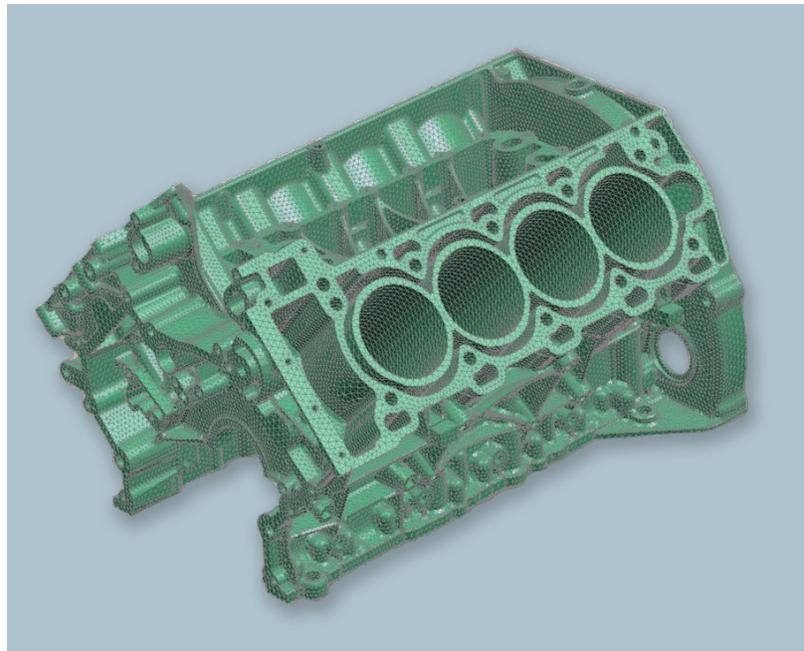
**Engineering data management.** NX seamlessly manages MCAD, ECAD, CAM, CAE and other product data, and integrates engineering, marketing, customer and government requirements into the knowledge base. Advanced search tools enable you to quickly locate product information by attribute or shape. Teams can classify, locate and easily re-use parts, products, processes and engineering knowledge.

**Engineering structure and configuration management.** Product teams can define and relate multiple BOM representations of the product structure for different lifecycle stages. You can use option and variant

management to organize your products into modules and marketing options, enabling your company to quickly respond to rising business opportunities.

**Engineering change and process management.** Revision and version controls, and preconfigured best practice workflows enable you to view the impact of proposed changes, and administer and execute them. Workflow and process management tools automate workflow processes and route product information for review/approval.

**Open application and system integration.** Siemens' open PLM foundation enables your company to integrate mission-critical ERP, CRM and SCM investments into your NX environment, and accommodate new suppliers, partners and customers.



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## **About Siemens PLM Software**

Siemens PLM Software, a business unit of the Siemens Industry Automation Division, is a leading global provider of product lifecycle management (PLM) software and services with nearly 6.7 million licensed seats and 69,500 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with companies to deliver open solutions that help them turn more ideas into successful products. For more information on Siemens PLM Software products and services, visit [www.siemens.com/plm](http://www.siemens.com/plm).

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